



论文摘要

中南大学学报(自然科学版)

ZHONGNAN DAXUE XUEBAO(ZIRAN KEXUE BAN)

Vol.32 No.4 Aug.2001

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文章编号: 1005-9792(2001)04-0417-05

基于DSP和模糊PD控制的智能 人工腿位置伺服控制系统

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摘要: 智能人工腿最显著的特点是能模仿人体健康腿的运动方式且步行速度可自然、随意地跟随截肢者步行速度的变化而变化. 对其进行研究对改善残疾人的生存条件和促进医疗事业的发展具有重要的现实意义. 以前研制的智能人工腿, 其汽缸内针阀开度的控制都是采用步进电机所构成的开环系统, 位置精度不高, 为此, 作者针对智能人工腿的控制原理和TMS320F240数字信号处理器的主要特点, 设计了一种基于TMS320F240的直流电机模糊位置伺服控制系统的结构, 并对该位置伺服系统进行了计算机仿真. 实验结果表明, 所设计的伺服控制系统具有智能性、鲁棒性、快速性和准确性, 可以有效地用于智能人工腿的行走控制.

关键词: 智能人工腿; 数字信号处理器; 位置伺服控制系统; 模糊控制策略

Servo control system for intelligent artificial legs based on DSP chip and fuzzy PD control strategy

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Abstract: Intelligent artificial leg has been an interesting research project in the fields of robotics and biomedical engineering. It has the following excellent characteristics. It can imitate the movement ways of human healthy legs and its walking speed can change naturally with the change of the disables' walking speed. The research on this project is of practical significance to improve the living situation and benefit the disabled. In the past years, several intelligent artificial legs have been developed, such as IP, IP+ and NI-C111. But the controller used for regulating the turn-down ratio of needle-plug valve in these legs is an open-loop system with a stepping motor, so it has lower position precision. In this paper, we will design a closed-loop control system with position and speed feedback and adopt fuzzy PD control strategy so as to improve the intelligent behavior, robustness, response speed, and accuracy of this control system. First, we give introductions, to the control principle of intelligent artificial legs and main characteristics of TMS320F240 digital signal processor, and then propose a system structure for the D.C motor position servo control of intelligent artificial legs based on fuzzy logic and TMS320F240. The result of computer simulation for this control system indicates that the design method proposed here is correct and can be used effectively to control the walking movements of intelligent artificial legs.

Key words:intelligent artificial leg; digital signal processor; position servo system; fuzzy control strategy

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